

Spina Bifida

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by

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A Series of Cases of Spina Bifida treated by Plastic Operation. By A. W. MAYO-ROBSON. Read March 27, 1885.

IN 1881 the following paragraph attracted my attention in one of the leading text-books on surgery :—"Viewing, then, the great danger of any effectual surgical treatment in cases of spina bifida, it seems better to watch the case carefully, and not to interfere unless the tumour is growing." This led me to carefully think over the subject with a view to carrying out some more definite lines of treatment than those hitherto adopted, which seemed to me very uncertain and very frequently fatal.

It was not, however, till the end of 1882 that I had a chance of putting my ideas into practice, the result quite coming up to my anticipation. I have since that time operated on four cases; have seen the operation done by Professor Jessop and Mr. Atkinson, my colleagues at the Leeds Infirmary; and have also had a letter from Dr. Robert T. Hayes, of Rochester, U.S.A., telling me that he has operated successfully by the same method.

My first case was fully described in a paper in the *Brit. Med. Journ.* for March 24, 1883; hence I need only quote it briefly.

CASE 1.—A. S., a fairly well-nourished child, æt. 6 days, the subject of a spina bifida in the lumbar region the size of an orange, was operated on at such an early age, because the sac was excessively thin, had become inflamed at the fundus and threatened to burst.

The operation done on October 26, 1882, was as follows: When the infant was fully under the influence of chloroform I made a vertical incision through the skin on each side of the tumour, about half an inch from its base, and then very carefully dissected the integuments from the meninges, until I reached the laminae of the vertebrae; this required very careful dissection, as the membranes left were so thin as to be perfectly translucent; the fluid was now let out by puncturing with fine scissors, which were also used to cut away the redundant membranes. The cauda equina was fully exposed,

lying on the floor of the spinal canal. I now had two folds on each side, each fold being of a different width, the two inner meningeal folds three fourths and half an inch respectively, and the two skin-flaps of the same width; but whilst the wider meningeal flap was on the right, the wider skin-flap was on the left. Thus, when sutures were applied, the lines of union were not opposite.

Acting on the same principle as is carried out in uniting the peritoneum, I brought together the serous surfaces of the arachnoid by several sutures, so as to completely shut off the spinal canal.

Mr. Mayo had, in the meantime, been dissecting (under the antiseptic spray) the periosteum from the femur and frontal bone of a rabbit, which he had just killed. This periosteum I now placed, with its osteogenic layer undermost, over the closed meninges, and carefully sutured it to the periosteum of the laminae on each side, and to the bony margins above and below. After this the skin was sutured, a layer of protective applied, and a pad of salicylic wool placed over the wound.

The whole operation, which occupied more than an hour, was performed under the eucalyptus air. Catgut ligatures were employed, and the instruments and sponges were well carbolised. On the second day, the nurse in applying the napkins displaced the dressing; but although the skin-wound slightly opened there was no formation of pus, and no slough came away; in fact, through the small opening I could see that granulations had covered the superficial surface of the interposed periosteum. The child recovered without a bad symptom, and when shown to the Leeds and West Riding Medico-Chirurgical Society in December, 1882, two months after, the skin of the lumbar region was quite flat, and only presented a cicatrix where the tumour had been.

A thin shield was worn in order to protect the tender part of the spine. Six months after, the child was perfectly well in every respect; but when nearly a year old it died from teething convulsions after a day's illness, and no autopsy could be obtained. The portion of sac removed I show you in the jar handed round.

CASE 2.—Mary A., æt. 18 days, a puny, ill-developed child of weakly parents, with a questionable history of syphilis, but without any family history of deformity, was brought to me with a spina bifida in the lumbar region, the size of a large orange, the coverings being so thin and translucent quite up

to the margin of the tumour that it was quite evident that no integumental cover could be obtained from the surface of the swelling, and as the skin all round was inflamed and beginning to ulcerate the case was not of a promising nature, but as it was quite evident the child must die shortly unless relieved I decided to operate.

Operation December 5, 1882.—The translucent membrane was partly cut away, just sufficient being left to form the meningeal cover, which was sutured with catgut over the opening into the spinal canal, that being three quarters of an inch wide and two inches and a quarter long; the skin was then dissected up over the loins so as to allow two flaps to be slid towards the middle line, where they were joined together over the meninges by silver sutures.

The whole operation was done strictly antiseptically. The after-progress locally was all that could be desired, the wound apparently healing by first intention without any signs of inflammation, but when the silver sutures were taken out on the third day the centre of the skin wound reopened a little, showing granulations springing from the meninges; the wound was supported by strapping.

The general condition was not altered, and although there was no elevation of temperature and no purulent discharge from the wound, the condition of marasmus present on admission continued, and the child died, apparently from asthenia, on the evening of December 8, 1882.

Post-mortem report by Dr. Griffith, house physician.—“All the lumbar and the two upper sacral vertebræ were found to be bifid; the meningeal wound had healed and the skin wound almost. There was no evidence of meningitis, and no apparent increase or diminution in the amount of cerebro-spinal fluid.” The bifid spine which I pass round shows well the extensive deformity.

CASE 3.—Elizabeth J., æt. 16, residing in Armley, was admitted on November 4, 1884, into the infirmary, suffering from spina bifida and talipes equino-varus. She said that she had no relations similarly affected. Up till the age of seven her feet were perfectly normal, after which time she commenced walking on her toes, the pedal deformity having from that time gradually increased.

During the last month the spina bifida had slightly enlarged, but had given no pain except when handled, and she had been entirely free from all head symptoms.

She sought advice on account of the deformity of the feet, and was admitted as an in-patient to Leeds General Infirmary in order to have tenotomy performed; but the day after admission the spina bifida, which was situated in the lumbar region, and was about the size of a large foetal head with somewhat thin covering, began to weep from several points at its fundus; a clear watery non-albuminous fluid transuding in such quantity that a thimbleful was easily collected for analysis. This continued for three days, during which time the tumour was dressed with salicylic wool changed from time to time. The tumour was now much increased in size, very tense and hot to the touch; and at the same time, as shown by the chart, the temperature in the axilla was raised.

The patient now complained of headache, was restless, cross, and peevish; answered sharply when spoken to, looked pinched and extremely ill; the pupils were dilated, eyes blood-shot, skin was cold and clammy, pulse feeble and flickering, breathing rapid. Potassium bromide was ordered to be taken. Ice was applied to the tumour and hot bottles to the feet; these gave relief to a certain extent, but on November 13 the tumour was so tense and the headache and other nervous symptoms so severe that it was felt that unless relief could be given the patient must soon die. Aspiration was performed with full antiseptic precautions, 16 oz. of a clear transparent fluid (cerebro-spinal) being withdrawn; the pupils immediately gained their normal condition although the pain in the head became very much increased, but after half an hour the patient slept comfortably, and the temperature fell from 102° to normal. When the sac was empty the opening into the spinal canal could be felt to admit three fingers. The relief was of short duration, all the symptoms returning by the 15th, when the patient was very restless and constantly moaning, refusing food and complaining of intense headache, the pupils being dilated and sluggish.

November 16.—Aspiration was again performed, when 6 oz. of clear fluid were withdrawn, giving relief as before; on the 19th aspiration became again necessary, and 14 oz. of fluid were removed. A general consultation was held with a view to further operative treatment, but it was decided that the patient would stand the best chance by continuing the same treatment; hence the aspirations were repeated, and on the 21st 8 oz., 23rd 10 oz., 25th 10 oz., December 5th 12 oz., and 8th 7 oz., of fluid were withdrawn. At the fifth aspiration the fluid was slightly cloudy, at the sixth, seventh and eighth, it

was decidedly purulent but sweet, strict antiseptic precautions having been observed throughout.

On December 10, as the patient was getting decidedly worse and the temperature was keeping high, the headache and other nervous symptoms still continuing, it was felt that unless something more decided was done the patient must shortly sink.

On December 11, the following operation was performed. A large crucial incision was made, so as to raise four triangular flaps of skin, with their bases outwards, from the surface of the tumour, the dissection being performed so as to separate skin from sac without puncturing the latter; after the base of the tumour had been reached the thin fundus was opened, when it was found that there were no nerves in its walls, and as the sac was inflamed, and was lined with a thick layer of lymph, it was completely removed quite down to the base, which was in some parts nearly an inch thick. There being a good deal of hæmorrhage, about twenty catgut ligatures were applied to vessels. The base of the sac (as proved by passing a probe) communicated with the spinal canal, the opening being surrounded by lymph. The skin-flaps were accurately brought together by silver sutures and a large drainage-tube was inserted; the whole operation was done antiseptically and the wound was dressed on the 13th, 16th, 20th, when the drainage-tube was removed, and the 24th, when the wound was perfectly healed. From the time of the operation the patient gradually gained strength, lost her nervous symptoms, and was discharged cured on January 5, twenty-four days after operation. The accompanying temperature chart very clearly shows the progress of the case.

February.—At the present time the patient wears an oval vulcanite pad over the site of the tumour; she is perfectly well, and intends to come into the infirmary after a time to have her feet operated on.

Patient exhibited to the Society.

Temperature Record.

		A.M.		P.M.
Nov. 5	...	98·4°	...	99·4°
6	...	98·4	...	100·0
7	...	98·2	...	99·2
8	...	98·2	...	99·4
9	...	97·5	...	99·8
10	...	97·9	...	100·6
11	...	99·8	...	101·8

		A.M.		P.M.			
Nov. 12	...	100·8°	...	101·2°			
13	...	102·4	...	102·0	Aspiration.	16 oz.	Watery fluid.
14	...	98·0	...	98·8			
15	...	98·9	...	100·9			
16	...	100·9	...	98·0	Aspiration.	6 oz.	
17	...	99·6	...	100·0			
18	...	100·0	...	99·8			
19	...	100·6	...	98·4	Aspiration.	14 oz.	
20	...	100·4	...	101·2			
21	...	99·8	...	102·4			
22	...	100·4	...	100·2	Aspiration.	8 oz.	
23	...	99·6	...	101·6	Aspiration.	10 oz.	
24	...	99·0	...	100·2			
25	...	102·3	...	103·2	Aspiration.	12 oz.	
26	...	103·0	...	99·6			
27	...	98·2	...	101·6			
28	...	99·8	...	100·4			
29	...	99·8	...	101·2			
30	...	100·4	...	100·8			
Dec. 1	...	100·0	...	101·0			
2	...	100·0	...	101·0			
3	...	100·4	...	101·2			
4	...	100·2	...	101·2			
5	...	100·4	...	102·4	Aspiration.	Pus 12 oz.	
6	...	98·4	...	100·2			
7	...	99·0	...	99·0			
8	...	101·4	...	100·8			
9	...	99·2	...	102·2	Aspiration.	Pus 7 oz.	
10	...	103·2	...	102·8			
11	...	101·6	...	98·4	Operation of excision of sac at 3 p.m.		
12	...	100·4	...	100·4			
13	...	99·4	...	100·4	Dressed.		
14	...	99·8	...	99·4			
15	...	98·2	...	100·0			
16	...	99·2	...	100·8	Dressed.		
17	...	98·2	...	99·2	After which a normal temperature.		
24	...	—	...	—	Dressed and found healed.		

CASE 4.—Notes of this case were furnished me by my house surgeon, Mr. A. Atkinson, to whose care and attention the successful result of this and the last case are in a great measure due.

Daniel C., æt. 7 weeks, the child of healthy parents, was admitted into the Leeds Infirmary on January 31st, 1885, suffering from a large spina bifida in the lumbar region. The child was puny and badly nourished. It had a large head with open fontanelles and dilated veins, the face was thin and small, but the eyes were not prominent. The tumour measured seven and a quarter inches in circumference and three and a half inches across, the coverings being very thin and ulcerated at the fundus.

On February 5, Mr. Robson, operating under the eucalyptus air, made a vertical incision along the right of the tumour and tried to dissect the skin from the meninges, but, owing to the coverings being thin, the sac was perforated and cerebro-spinal fluid escaped; the dissection being continued, a wider meningeal flap was taken from the left and made to bridge over the opening in the spinal canal, which was one inch long by half an inch wide, being there united by a continuous catgut suture to a narrow meningeal fold on the right; the redundant integument having been excised, the skin-flaps were united along the middle line by silver sutures. The nervous contents of the spinal canal were in no way interfered with. Before the operation was completed, the child became suddenly collapsed, apparently owing to the chloroform; suspension by the feet and artificial respiration restored it, and the operation was completed.

A drainage-tube was inserted between the skin and meninges, and the wound was dressed with a layer of gauze dipped in carbolic solution and covered with salicylic wool, this being well covered with adhesive plaster to prevent soiling of the dressings.

February 7.—Drainage-tube and wire sutures removed, child looking well and wound apparently healed.

February 8.—Temperature rose to 104.5° but sodium salicylate gr. j, every hour reduced it to $99\frac{4}{5}^{\circ}$ in a few hours.

The temperature fluctuated till the 12th, after which it was normal, but during the whole time the wound looked well and showed no sign of inflammation.

On the 11th, *i.e.* six days after operation, the fontanelles were depressed as they appear in a child suffering from choleraic diarrhoea; this lasted two days, and the infant rolled its head from side to side as if uneasy, but it did not cry.

On the 16th the fontanelles were well filled and the head looked large, but the mother said that it was no larger than before operation. Discharged from the infirmary on the 18th, thirteen days after operation, apparently well but weak.

March 20.—The child was brought to the infirmary to have a pad adjusted.

The site of the tumour presented a linear scar showing the old line of incision, and the skin was on a level with that over the loins and sacrum.

Child exhibited to the Society, March 27, 1885.

Temperature Chart.

	A.M.		P.M.	
Feb. 5	...	—	...	98.2° Operation. Exeision of sac and suturing of meninges and skin-flaps.
6	...	100.0°	...	98.2
7	...	101.0	...	100.8
8	...	103.0	...	104.8
9	...	104.8	...	99.8 Temp. reduced by gr. j Sod. Salicyl. every hour for six doses.
10	...	102.0	...	98.6 Sod. Salicyl. repeated.
11	...	101.8	...	99.4
12	...	101.0	...	99.4
13	...	98.6	...	99.6
14	...	98.6	...	99.0
15	...	99.6	...	99.6
16	...	98.6	...	98.8
17	...	98.6	...	98.8 Discharged cured.

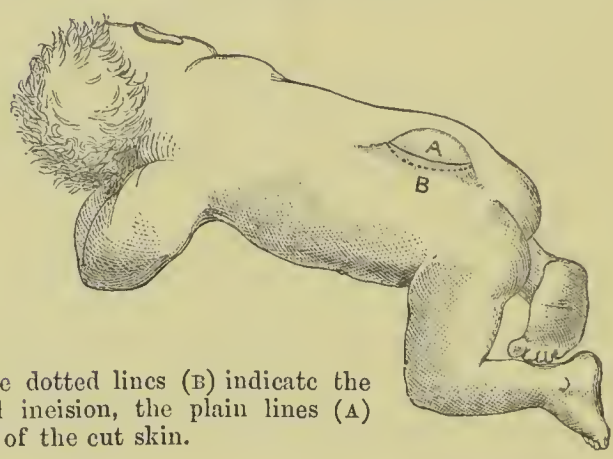


FIG. 1.—The dotted lines (B) indicate the meningeal incision, the plain lines (A) the edges of the cut skin.

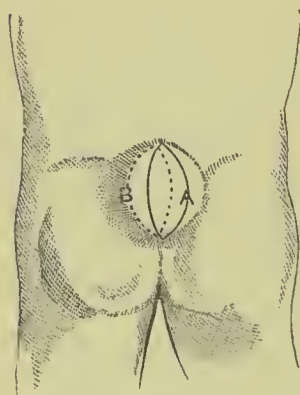


FIG. 2.—The dotted lines (B) indicate the meningeal incision, the plain lines (A) the edges of the cut skin.



FIG. 3.—Showing the meningeal and skin flaps.

The points to which I would draw attention are :

1. The principle of closing the meninges by bringing together two serous surfaces as in peritoneal surgery, and superimposing separate skin-flaps, the meningeal and skin lines of suture not being opposite.

2. The great importance of observing strict antiseptic precautions, as a septic condition would probably end in the same way as these cases usually do when they spontaneously ulcerate, viz. by meningitis and convulsions.

3. The success attending the plastic operation in cases which are absolutely not amenable to any other form of treatment, *e.g.* when the coverings are thin or the opening into the spinal canal large.

4. The possibility of transplanting periosteum and its capability of surviving; as in the case read first; although in that example bone did not form, one may hope that the use of human periosteum (*e.g.* from a recently amputated limb) will give better results.

5. The successful issue of Case 3, where, although the sac was acutely inflamed, its complete removal with efficient drainage effected a cure. This case presents several points of pathological importance, *e.g.* :

(a) The increase of temperature without septicity, apparently due to tension of, or pressure on, the great nerve centres.

(b) The great relief given by aspiration.

(c) Suppuration in the sac, possibly due to simple tension, probably not due to septicity, as the fluid was quite sweet on every occasion.

(d) The entire absence of brain symptoms after operation, although the pressure on the cerebro-spinal centres must have been considerably interfered with during the time the wound was healing.

I would suggest the following as a practical classification of cases of spina bifida for purposes of treatment :

1. Where no operation can or should be done.

2. Where no operation need be done.

3. Where an operation should be done.

CLASS 1.—Where no operation should be done.

(a) Where the deformity is very extensive, as in fissure of the whole or a considerable portion of the vertebral canal.

(b) Where there is complete paraplegia, as in a case my friend, Dr. Libbey, of Horsforth, asked me to see with him, where the sac was large and excessively thin quite to its

margin, and where the lower extremities hung absolutely powerless.

(c) Where the sac is large, the fissure extensive, and the coverings excessively thin quite to the edge of the tumour, and no skin can be obtained to cover the meninges. But that such extreme examples may stand a chance of cure is proved by Case 2.

CLASS 2.—Where nothing need be done.

Where the sac is small, and the coverings are so dense and firm as to form a good pad over the opening in the spinal column, as in the case of a girl of fourteen, whose mother brought her to see me a few months ago, where I advised a thin silver shield to be worn over the swelling to protect it from injury and prevent further bulging.

CLASS 3.—Where some operation should be done.

(a) Where the sac only communicates with the spinal canal by means of a small opening; here it is a simple matter to dissect off the skin, expose the neck of the sac, ligature it by means of one circular ligature, and cut off the redundant meninges, bringing the skin over so as to have the line of skin sutures quite at the side away from the pedicle. Such an operation was performed by Mr. Edward Atkinson, one of my colleagues at the Leeds Infirmary.

(b) Where the sac has a good skin cover and communicates with the spinal canal by a large opening it is quite easy to perform the operation described in Case 1, carefully closing the meninges, and if possible placing the line of skin sutures away from the meningeal line of union. Such cases have been operated on successfully, not only by myself but by Professor Jessop, of Leeds, and by Dr. R. Hayes, of Rochester, U.S.A. Human periosteum might be placed between the meninges and skin, but I am not at all sure that a thin plate of bone if formed would be very serviceable, although I hoped to obtain it in the first of my cases. If the expanded neural arches be large, I think it might be advisable to bend them towards the central line, and by uniting them with thin silver wire to obtain a truly physiological closure of the spinal canal. I have not had a chance of trying this plan as yet.

(c) Where the coverings are excessively thin quite to the margin of the tumour, as in Case 2, the operation is more difficult and uncertain, as the skin can only be obtained by a process of sliding from the contiguous parts, and the tension necessarily present is not conducive to healing.

(d) Where the spinal cord or the nerves are blended with

the sac, a condition which often cannot be diagnosed until the dissection of the skin from the meninges is made, I should advise excision of portions of the redundant meninges between the nerves, replacing the nervous structures in the spinal canal and bringing over the skin cover, keeping up free drainage between the membranes and integuments ; or, if this could not be done, the membranes might be punctured, the collapsed sac with the nervous structures intact be placed in the canal, and the skin cover made as before.

It is important to remember that a silver or leather shield should be worn over the site of operation in order to protect the parts from injury and to prevent the cicatrix from stretching or giving way.

